Space Weather Forecast

Issued on Saturday, 09 July 2022 at 01:12 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: R1 Radio Blackout observed, chance of further such events from moderate class X-ray flares. Coronal Mass Ejection (CME) generated, awaiting further imagery for analysis.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity rose sharply to become moderate in the past 24 hours, with a long-period moderate class X-ray flare recorded from the largest and most complex sunspot on the facing side at 08/2048UTC. Prior to this, activity had been very subdued, with only occasional small common-class flares observed.

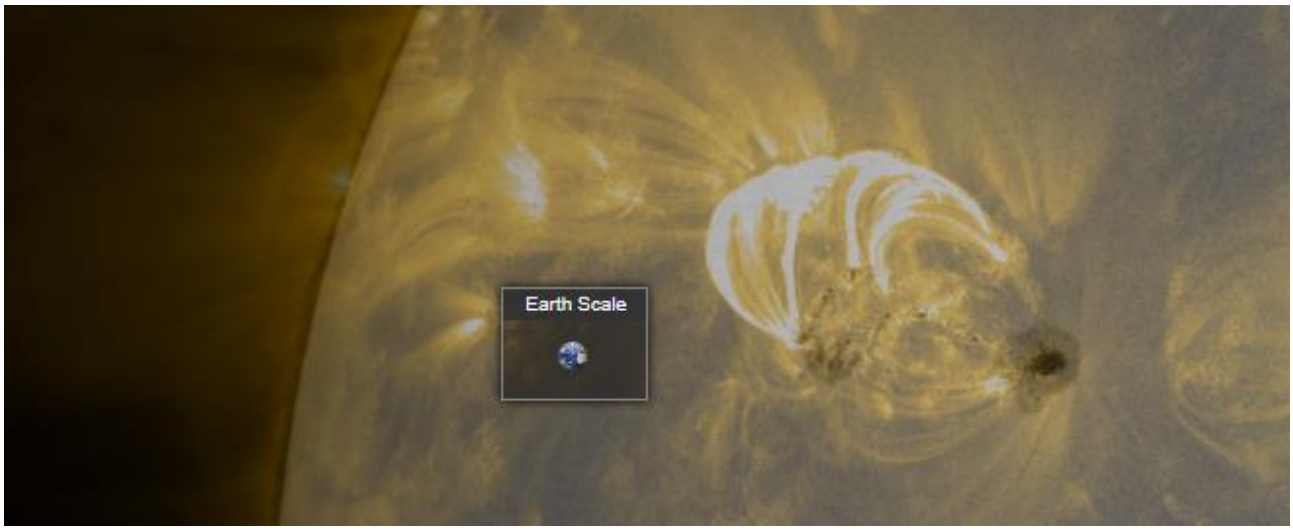

Figure 1: False-colour composite image of the 08/2048UTC X-ray flare from the largest and magnetically most complex region on the Sun, with the Earth shown for scale. A proxy for the magnetic field is shown in yellow, with the sunspots in black and grey. Image processing courtesy of helioviewer.org.

There are now five sunspot regions on the Sun. As stated, the largest and most complex was the group that produced the moderate-class flare, with this activity capping some proliferation of its intermediate spots early in the day and a later spreading tendency. Also of note on the Earth-facing side in terms of complexity were a magnetically bipolar region to its east, with growth in its intermediate spots for a time then migrating into the leading cluster. The other groups on the Sun were smaller and simpler, with one fading away entirely.

There are currently numerous large 'filaments' on the Sun (arcs of plasma, potentially CMEs should they erupt), with the southeast of the Sun in particular harbouring two large features that each span roughly 20 degrees. There were no signs on instability in these in the reporting period, however they will become increasingly relevant should they lift off in the coming few days and will

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be monitored. Other areas of note included the southwestern solar horizon, which saw a non-Earth directed 'prominence' lift-off (arc of plasma from the sun's edge).

The fact that the moderate class X-ray flare was both long-period and showed accompanying dimming in some extreme UV imagery are both expected to mean that some form of CME has been produced, with early imagery suggesting that this is mainly east of the Sun-Earth line, to be confirmed. No Earth-directed CMEs have been observed in available imagery over the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind showed influence from CME for much of the period, perhaps segueing into some residual influence from a coronal hole fast wind for a time, before this too faded into the UTC evening.

The solar wind speed showed a roughly level and then decaying trend in the 24 hours, mainly within slightly elevated levels. The number of particles comprising the solar wind was somewhat erratic and often slightly elevated, with an overall slightly reducing trend. The magnitude of the magnetic field was elevated in the CME, although fortunately the north-south component often showed a co-aligned bias with the Earth's field to mitigate against geomagnetic effects.

The net effect of the above solar wind measures was an overall fall from early Minor Storm G1 intervals in the 00-03 and 03-06UTC intervals, becoming more readily quiet into the UTC evening.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain low, but with a daily chance of moderate-class flares. A progressive slight increase is possible in the four days, as while no significant sunspot regions leave the Earth-facing side, up to two may return over the eastern solar horizon.

Solar Wind / Geomagnetic Activity: There is a small residual chance of some influence from the shock of the 05 July CME early on day one, although effects are now likely to be muted for the long transit time - if even present. In addition, the CME from the aforementioned moderate class flare is as yet unanalysed, but may carry an Earth-directed component. No other CMEs feature.

No further coronal hole fast wind influences are expected in the period. A satellite two days upwind of Earth does hint that a minor fast wind enhancement may occur in two days' time (with uncertain attribution), however the size of disturbance is currently modest, and significant activity is not expected.

Activity should therefore wane through the period, with an initial slight chance of Minor Storm G1 should any 05 July CME influence materialise, before becoming reliably quiet by the new UTC working week. Note that this does not account for any further CME influence.

Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, solar radiation storms are not anticipated, however there is a very slightly rising tendency with the usual westward progression of the front-side large sunspot groups.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	20	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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